PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-167510

(43)Date of publication of application : 22.06.2001

(51)Int.Cl. G11B 19/12
G11B 7/004
G11B 20/10

(21)Application number : 2000-297188

(22)Date of filing : 28.09.2000

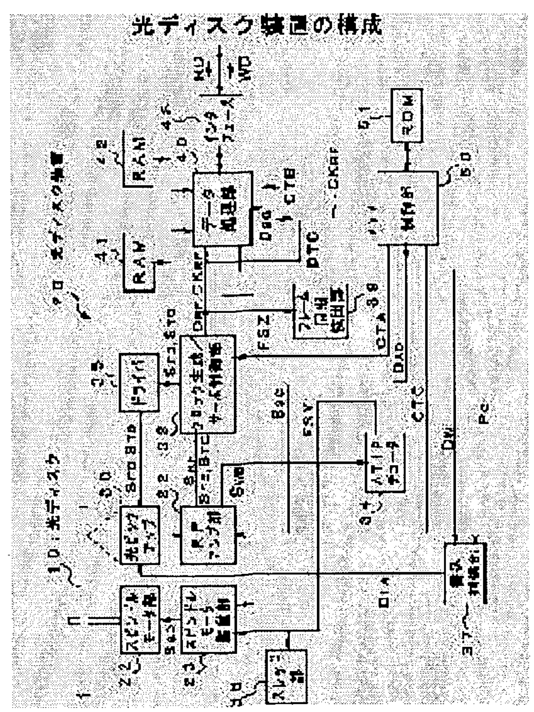
(71)Applicant : SONY CORP

(72)Inventor : IIDA MICHIHIKO
KAWASHIMA TETSUJI
OTA SHINJI

(30)Priority

Priority number : 11275196 Priority date : 28.09.1999 Priority country : JP

(54) OPTICAL DISK DISCRIMINATION METHOD AND OPTICAL DISK DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To easily discriminate whether or not an optical disk is made large in recording capacity.

SOLUTION: The optical disk 10 is rotated at a required speed and on a required position, and a signal recorded on the optical disk is read. When the optical disk is an read-out exclusive optical disk, a frequency of a clock CKRF of a regenerative signal is detected with a control port 50. Because of the frequency of the clock of a standard optical disk is different from a high density optical disk. For instance, when the recording density is double of the standard density, the clock frequency of the high density optical disk becomes 1.4 times. As another discrimination method, by large/small of a burst error signal based on a difference of a unit delay amount at an interleave processing time, the optical disk is discriminated. when the optical disk is a writable type, by detecting the

frequency of a wobble signal, or detecting an error correction result of a round code, whether the optical disk is standard standard density one, or high density one is discriminated simply and surely, and the configuration is simple.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The optical disk distinction approach characterized by distinguishing the optical disk recorded by high density from the optical disk recorded by normal density by the number of the clocks extracted from the regenerative signal reproduced from the optical pickup, and normal density when an optical disk is a read-only optical disk.
[Claim 2] The clock generation / servo control section to which the regenerative signal outputted from the optical pickup is supplied, The control section to which the clock outputted from this clock generation / servo control section is supplied is prepared. This clock generation / servo control section It has the edge detector of the regenerative signal made binary, and the clock generation section generated based on the edge output. The clock signal outputted from this clock generation section is supplied to the above-mentioned control section, and counting of the above-mentioned clock signal is carried out. By the size of the number of clocks per unit time amount The optical disk unit characterized by distinguishing the optical disk recorded by high density from the optical disk recorded by normal density, and normal density.
[Claim 3] The optical disk unit according to claim 2 characterized by preparing the data-processing section which decodes the regenerative signal from the optical disk recorded by the above-mentioned normal density, and the data-processing section which decodes the regenerative signal from the high-density and recorded optical disk in the data-processing section of the above-mentioned regenerative signal, and choosing the above-mentioned data-processing section by the size of the above-mentioned number of clocks.
[Claim 4] The optical disk distinction approach characterized by to distinguish the optical disk of the above-mentioned normal-density record, and the optical disk of high-density record from the size of the error by the difference in this amount of unit delay when it is a read-only optical disk and is that from which the amount of unit delay at the time of interleave processing of the signal recorded is different with the signal recorded by normal density, and the signal recorded by high density rather than the above-mentioned normal density.
[Claim 5] The signal with which the amount of unit delay at the time of interleave processing of the signal recorded was recorded by normal density, It is an optical disk unit to a read-only optical disk which is different with the signal recorded by high density rather than the above-mentioned normal density. In the data-processing section to which the regenerative signal outputted from the optical pickup is supplied The processing section of the error correcting code inserted in the regenerative signal from the optical disk of normal density, The processing section of the error correcting code inserted in the regenerative signal from the optical disk of high density, While the disk distinction section to which the error signal obtained from these processing section is supplied is prepared and the size of the error based on a difference of the above-mentioned amount of unit delay is distinguished in this disk distinction section The optical disk unit characterized by being made as [choose / the error correcting code processing section of a side with few above-mentioned errors].
[Claim 6] The optical disk unit according to claim 5 characterized by using a burst error signal as said

error signal.
[Claim 7] While the changeover switch which changes alternatively the clock supplied to the error correcting code processing section of a top Norikazu pair is prepared and this changeover switch is controlled based on the output of the above-mentioned disk distinction section When it is distinguished in the above-mentioned disk distinction section that the error block count of the error signal in the error correcting code processing section of the method of Norikazu after the above-mentioned clock is supplied first is zero The above-mentioned clock was supplied for while and the error correcting code processing section is chosen as the processing section at the time of playback. When it is judged that the error block count of the error signal from the error correcting code processing section of the method of top Norikazu is larger than zero While supplying the above-mentioned clock to the error correcting code processing section of above-mentioned another side, the error signal from this error correcting code processing section is distinguished. The optical disk unit according to claim 5 characterized by choosing the error correcting code processing section of this another side as the processing section at the time of playback when the error block count of the error signal at that time is zero.
[Claim 8] The optical disk unit according to claim 7 characterized by choosing the error correcting code processing section of above-mentioned another side as the processing section at the time of playback in the time of the error block count of the error signal from the error correcting code processing section of above-mentioned another side not being zero, either when the error block count of the error signal from above-mentioned one error correcting code processing section is below the 1st [for disk distinction] reference value.
[Claim 9] The optical disk unit according to claim 5 characterized by being made as [choose / based on the error signal which the above-mentioned data-processing section consists of C1 decoder, the 1st and 2nd day interleave processing sections from which the amount of unit delay is different, and C2 decoder at least, and is obtained from the C2 above-mentioned decoder / any of the above 1st and the 2nd day interleave processing section they are].
[Claim 10] When the error block count of the error signal from the C2 above-mentioned decoder when choosing the day interleave processing section of the above 1st is zero This 1st day interleave processing section is used as the day interleave processing section at the time of playback, and when the error block count of this error signal is not zero Distinguish the error signal from the C2 above-mentioned decoder obtained when it changes to the day interleave processing section of the above 2nd, and when the error block count of this error signal is zero The optical disk unit according to claim 9 characterized by being made as [choose / this 2nd day interleave processing section / as the day interleave processing section at the time of playback].
[Claim 11] The optical disk unit according to claim 9 characterized by choosing the day interleave processing section of the above 2nd as the day interleave processing section at the time of playback when which the day interleave processing section is chosen and the error block count of the error signal when using the day interleave processing section of the above 1st in the time of the error block count of an error signal not being zero is below a reference value for [1st] disk distinction.
[Claim 12] The optical disk unit according to claim 9 with which the day interleave processing section of the direction with little error block count is characterized by being used as the day interleave processing section at the time of playback among the error signals from the C1 above-mentioned encoder and C2 encoder when the error block count of the error signal obtained from the C1 above-mentioned decoder is beyond a reference value for [above-mentioned / 1st] disk distinction and is below the 2nd reference value.
[Claim 13] It is the optical disk unit according to claim 9 characterized by making it judge that they are causes of an error other than a disk when the error block count of the error signal which the error block count of the error signal obtained from the C1 above-mentioned decoder exceeds the 2nd reference value of the above, and is obtained from the C2 above-mentioned decoder is over the 3rd reference value for disk distinction.
[Claim 14] The optical disk unit according to claim 5 characterized by performing distinction processing in said disk distinction section in software.

[Claim 15] The distinction approach of the optical disk characterized by distinguishing the optical disk recorded by normal density by detecting the frequency of the WOBURU signal which is the optical disk of a write-in mold and was recorded on this optical disk, and the optical disk recorded by high density rather than this normal density.
[Claim 16] The band-pass filter with which the WOBURU signal outputted from the optical pickup is supplied and with which passbands differ, respectively, It consists of the disk distinction section to which the filter output is supplied, respectively, and the data-processing section to which the regenerative signal outputted from the above-mentioned optical pickup is supplied. The above-mentioned data-processing section While having the data-processing section which processes the regenerative signal from the optical disk of normal density, and the data-processing section which processes the regenerative signal from the optical disk of high density and distinguishing the existence of the above-mentioned filter output in the above-mentioned disk distinction section The optical disk unit characterized by processing the above-mentioned regenerative signal using the data-processing section of the side from which the filter output was obtained.
[Claim 17] The optical disk unit according to claim 16 characterized by having prepared the decoding section which processes the WOBURU signal from the optical disk of normal density, and the decoding section which processes the WOBURU signal from the optical disk of said high density, having prepared the filter which extracts said WOBURU signal in each decoding section, and making this filter serve a double purpose as a band-pass filter for said optical disk distinction in the time-axis information decoder which decodes the time-axis information recorded on said optical disk.
[Claim 18] The distinction approach of the optical disk characterized by distinguishing said optical disk based on the error decision output of the cyclic code which the WOBURU signal which is the optical disk of a write-in mold and was recorded on this optical disk was detected, and was inserted in said WOBURU signal.
[Claim 19] The decoding section which decodes the time-axis information inserted in the WOBURU signal reproduced from the optical disk of normal density, The decoder of time-axis information consists of the decoding sections which decode the time-axis information inserted in the WOBURU signal reproduced from the optical disk of high density. In the address decoding section prepared in said decoding section While the processing section of a cyclic code is prepared, the disk distinction section to which the error decision output in this address decoding section is supplied, respectively is prepared. In this disk distinction section The optical disk unit characterized by choosing the decoding section of the direction with few said error decision outputs as the decoding section which reproduces said hour entry.
[Claim 20] It is the optical disk unit according to claim 19 characterized by performing processing in said disk distinction section in software.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical disk distinction approach and an optical disk unit. When an optical disk is rotated in a desired rate and a desired location, a signal is read in detail and the optical disk is a read-only optical disk, it enables it to distinguish the optical disk recorded by normal density, and the optical disk recorded by high density rather than normal density using the error signal based on a difference of the clock of the acquired signal or the amount of unit delay at the time of day interleave processing.
[0002] Moreover, it enables it to distinguish the optical disk which the optical disk wrote in, and was recorded by normal density using the error decision output of the existence of the frequency output of a WOBURU signal, and a cyclic code when it was a mold disk, and the optical disk recorded by high density rather than normal density.
[0003]
[Description of the Prior Art] In order for the demand of large-capacity-izing of an archive medium to increase and to raise recording density also in an optical disk in recent years, a track pitch is narrowed or approaches, such as shortening the shortest length of a record pit, are proposed.
[0004] Here, large capacity-ization of storage capacity is wished that more data are recordable also about the optical disk which fulfills the specification of a compact disk, for example, the optical disk of the postscript mold standardized by ISO/IEC 13490-1, (CD-R), and the optical disk (CD-RW) (these are named generically and written in below and it is called a mold optical disk) of a rewritable mold.
[0005]
[Problem(s) to be Solved by the Invention] By the way, with the optical disk unit which performs record playback of a signal, when large capacity-ization of storage capacity is attained with write-in mold optical disks, such as a postscript mold and a rewritable mold, in this way, if it cannot distinguish promptly easily whether it is the optical disk (optical disk of high density) with which large capacity-ization of storage capacity was attained, or it is the optical disk (optical disk of normal density) which is the conventional storage capacity, record playback actuation according to each disk cannot be performed. For example, before restoring to the data currently recorded on the disk, unless it can distinguish whether it is the optical disk of high density, neither processing peculiar to the optical disk of high density nor hardware of dedication can be chosen.
[0006] Moreover, although it is possible to record the data in which the classification of an optical disk is shown with the optical disk (blank disc) to which record of data is not performed since disk distinction cannot be performed using the data currently recorded, in such a case, the distinction processing cannot be performed to the already marketed optical disk.
[0007] So, in this invention, the optical disk and optical disk unit which can perform easily distinction of whether to be the optical disk with which large capacity-ization of storage capacity was attained including the existing optical disk are offered.
[0008]

[Means for Solving the Problem] By the optical disk distinction approach concerning this invention indicated to claim 1, when an optical disk is read-only, it is characterized by distinguishing the optical disk recorded by high density from the optical disk recorded by normal density by the number of the clocks extracted from the regenerative signal reproduced from the optical pickup, and normal density.
[0009] In the optical disk unit concerning this invention indicated to claim 2 The clock generation / servo control section to which the regenerative signal outputted from the optical pickup is supplied, The control section to which the clock outputted from this clock generation / servo control section is supplied is prepared. This clock generation / servo control section It has the edge detector of the regenerative signal made binary, and the clock generation section generated based on the edge output. The clock outputted from this clock generation section is supplied to the above-mentioned control section, and is characterized by distinguishing the optical disk recorded by high density from the optical disk recorded by the size of the number of clocks per unit time amount by normal density, and normal density.
[0010] By the optical disk distinction approach concerning this invention indicated to claim 4 When it is a read-only optical disk and is that from which the amount of unit delay at the time of interleave processing of the signal recorded is different with the signal recorded by normal density, and the signal recorded by high density rather than the above-mentioned normal density, From the size of the error after [which is depended on the difference in this amount of unit delay] being decoded, it is characterized by distinguishing the optical disk of the above-mentioned normal density record, and the optical disk of high density record.
[0011] In the optical disk unit concerning this invention indicated to claim 5 The signal with which the amount of unit delay at the time of interleave processing of the signal recorded was recorded by normal density, It is an optical disk unit to a read-only optical disk which is different with the signal recorded by high density rather than the above-mentioned normal density. In the data-processing section to which the regenerative signal outputted from the optical pickup is supplied The processing section of the error correcting code inserted in the regenerative signal from the optical disk of normal density, While the processing section of the error correcting code inserted in the regenerative signal from the optical disk of high density and the disk distinction section to which the error signal obtained from these processing section is supplied are prepared and the size of the above-mentioned error signal is distinguished in this disk distinction section It is characterized by being made as [choose / the error correcting code processing section of a side with few above-mentioned error signals].
[0012] By the optical disk distinction approach concerning this invention indicated to claim 15, it is the optical disk of a write-in mold, and is characterized by distinguishing the optical disk recorded by normal density, and the optical disk recorded by high density rather than this normal density by detecting the frequency of the WOBURU signal recorded on this optical disk.
[0013] In the optical disk unit concerning this invention indicated to claim 16 it outputs from an optical pickup -- having -- each to which a WOBURU signal is supplied -- with the band-pass filter with which passbands differ It consists of the disk distinction section to which the filter output is supplied, respectively, and the data-processing section to which the regenerative signal outputted from the above-mentioned optical pickup is supplied. The above-mentioned data-processing section While having the data-processing section which processes the regenerative signal from the optical disk of normal density, and the data-processing section which processes the regenerative signal from the optical disk of high density and distinguishing the existence of the above-mentioned filter output in the above-mentioned disk distinction section It is characterized by processing the above-mentioned regenerative signal using the data-processing section of the side from which the filter output was obtained.
[0014] By the distinction approach of the optical disk concerning this invention indicated to claim 18, it is the optical disk of a write-in mold, and the WOBURU signal recorded on this optical disk is detected, and it is characterized by distinguishing said optical disk based on the error decision output of the cyclic code inserted in said WOBURU signal.
[0015] In the optical disk unit concerning this invention indicated to claim 19 The decoding section which decodes the time-axis information inserted in the WOBURU signal reproduced from the optical

disk of normal density, The decoder of time-axis information consists of the decoding sections which decode the time-axis information inserted in the WOBURU signal reproduced from the optical disk of high density. In the address decoding section prepared in said decoding section While the processing section of a cyclic code is prepared, the disk distinction section to which the error decision output in this address decoding section is supplied, respectively is prepared. In this disk distinction section It is characterized by choosing the decoding section of the direction with few said error decision outputs as the decoding section which reproduces said hour entry.

[0016] In this invention, when an optical disk is a read-only optical disk, the frequency of the clock of a regenerative signal is detected to one. It is because the frequency of a clock is different with the optical disk of normal density, and the optical disk of high density. For example, when the recording density of the optical disk of high density is the recording density which is twice the normal density, the clock frequency in a high density optical disk will be 1.4 times the clock frequency in the optical disk of normal density.

[0017] If it is ** in the case where the amount of unit delay at the time of the interleave processing of the signal recorded as 2 records on the optical disk of normal density, and the case where it records on the optical disk of high density, when being carried out, an optical disk is distinguished by the size of the error signal (error block count) of the result of having carried out day interleave processing in each amount of unit delay.

[0018] The amount D of unit delay in the optical disk of normal density for example, by D= 4 (frame) When the amount D of unit delay in the optical disk of high density is D= 7, in the amount D= 4 of unit delay at the time of day interleave processing, and the made decoding section It becomes larger than the burst error when inputting the regenerative signal of the amount D= 4 of unit delay, the error signal (error block count of a burst error), for example, C2 error signal, when inputting the regenerative signal of the amount D= 7 of unit delay.

[0019] Therefore, it can be judged that the direction with few burst errors when adding a regenerative signal to each of the decoding section from which the amount D of unit delay at the time of day interleave processing was chosen as D= 4, and the decoding section chosen as D= 7 is the regenerative signal by which day interleave processing was carried out in the amount D of right unit delay.

[0020] Specifically, the day interleave processing section from which an error signal becomes zero is used as the day interleave processing section at the time of playback. When the error signal when using which the day interleave processing section does not become zero C1 error signal (error block count of a random error signal) from C1 decoder is compared with the reference value refD for [1st] disk distinction (as the number of errors, they are 10-20 pieces). When it is below the 1st reference value refD, the day interleave processing section chosen as D= 7 is used as the day interleave processing section at the time of playback. This is because it is thought that the direction of interleave processing of D= 7 does not interfere even if it judges it as the disk of high density in below the 1st reference value, since error correction capacity is high.

[0021] When a random error is beyond the disk distinction reference value refD and a random error is below the 2nd reference value refR (for example, 100), the day interleave processing section with little error block count is chosen among random errors.

[0022] For example, when the error block count has little direction at the time of D= 4, it is judged as the disk of normal density and the 1st day interleave processing section is chosen. Moreover, when the error block count has little direction at the time of D= 7, it is judged as the disk of high density and the 2nd day interleave processing section is chosen.

[0023] Moreover, when a random error exceeds the 2nd reference value refR and the burst error is over the 3rd reference value refB (for example, the error block count is 2000), it is considered an already different error from the error by the difference in the recording density of a disk. That is, it is thought that the error has occurred by another cause. In that case, it is convenient if an operator is told about that.

[0024] An optical disk writes in, and when it is the optical disk of a mold, to the 1st, an optical disk can be distinguished from the difference in a WOBURU frequency. When the optical disk of high density is

twice the recording density of normal density, since there is a 1.4 times as many aperture as this, the frequency of a WOBURU signal distinguishes an optical disk using this frequency difference.
[0025] When the polynomial which performs the error judging of a cyclic code is different from the 2nd by normal density and high density, a WOBURU signal is used as a regenerative signal and an optical disk is distinguished by the size of the error decision output.
[0026] For example, in order that the error decision output using the polynomial used with the optical disk of normal density may perform an error judging using the cyclic code generated by the ****** polynomial, the decision output at the time of the regenerative signal from the optical disk of normal density does not become zero to becoming zero at the time of the regenerative signal from the optical disk of high density. An optical disk is distinguished using this error decision-output difference. Thus, an optical disk can be distinguished simply and easily by using the WOBURU signal recorded on the optical disk.
[0027]
[Embodiment of the Invention] Then, this invention is explained to a detail below with reference to drawing 1 . By the specification of a compact disk, what the EFM (Eight to Fourteen Modulation) modulation of the signal with which encoding processing (error correcting code processing) of CIRC (Cross Interleave Reed-Solomon Code) was performed to the data recorded on an optical disk, and this CIRC encoding processing was performed is carried out, and is recorded on an optical disk is performed.

[0028] In CIRC encoding processing, while processing 8 bits as one symbol, at eight-to-fourteen modulation, the signal of 8 bits [per one symbol] data or parity acquired by carrying out CIRC encoding processing is changed into a 14 bits [per one symbol] signal. As shown in drawing 1 , while adding a 24-bit frame alignment signal and the sub-code signal of one symbol (14 bits) to this data of 32 symbols (32x14 bits) and signal of parity by which eight-to-fourteen modulation processing was carried out, the signal of the triplet for association between each symbol and association of a symbol and a frame alignment signal is added, and the signal of one frame (588-channel bit) is constituted.
[0029] The pattern with which, as for the pattern of a frame alignment signal, the two maximum channel pits continue here, Namely, the 24-bit change pattern shown by " billion 0001 0" as it is shown in drawing 2 A, when "1" shall show reversal is chosen. When the signal level in front of a frame alignment signal is a low level "L", as it is shown in drawing 2 B, 11T High level "H", When the signal level in front of the signal wave form where the following 11T are set to a low level "L", and a frame alignment signal is high level "H", it considers as the signal wave form shown in drawing 2 C. In addition, "T" is the minimum channel bit spacing.
[0030] Moreover, with the optical disk of a write-in mold like a postscript mold or a rewritable mold, PURIGURUBU PG which is a guide rail for a laser beam guide as shown in drawing 3 A is formed in the exposure side side of a laser beam among the specification of a compact disk. It is Land LA between two PURIGURUBU PG. As shown in drawing 3 B, WOBURU (meandering) of the both-sides side of PURIGURUBU PG is slightly carried out to the shape of a sine wave. The WOBURU signal SWB which took out this WOBURU component has required FM modulation, and the time-axis information on a disk which shows a location absolutely, the recommended value of the optimal record power of a laser beam, etc. are encoded.
[0031] When a disk rotates by standard speed (linear velocity 1.2 m/s - 1.4 m/s), the WOBURU signal SWB is formed so that center frequency may be set to 22.05kHz. Here, 1 sector of the ATIP (Absolute Time In Pregroove) signal as time-axis information is in agreement with 1 data sector after signal record (2352 bytes), and the writing of data is performed, taking the synchronization of a data sector to the sector of ATIP.
[0032] Drawing 4 shows the frame structure of ATIP information. 4 bits of the beginning are the synchronizing signal SYNC of ATIP information, and the "minute", the "second", and the "frame" which show the absolute time on a disk are shown by "2 Digit BCD" (8 bits), respectively. The 14 more-bit cyclic code CRC (Cyclic Redundancy Code) is added, and one frame consists of 42 bits. In addition, multiplex [of the information, such as an optimal record power recommended value of a laser beam,] is

carried out so that it may be contained at a rate in time-axis information.
[0033] Drawing 5 shows the alignment pattern of the synchronizing signal SYNC of ATIP information, and serves as a channel bit pattern which the biphase mark modulation of the ATIP information shown in drawing 5 A is carried out, and is shown in drawing 5 B or drawing 5 D. The biphase signal DBP after a biphase mark modulation is made into the wave shown in drawing 5 C here, the synchronizing signal SYNC of ATIP information being used as the channel bit pattern of "11101000" as it is shown in drawing 5 B, when a front channel bit is "0." Moreover, when a front channel bit is "1", as shown in drawing 5 D, it considers as the channel bit pattern of "00010111", and the biphase signal DBP is made into the wave shown in drawing 5 E.
[0034] Thus, if the biphase signal DBP is acquired, as shown in drawing 6 , FM modulation of the biphase signal DBP will be carried out, and the WOBURU signal SWB will be generated. For example, when the biphase signal DBP shown in drawing 6 A is made into high level "H", as it is shown in drawing 4 B, when considering as 23.05kHz and a low level "L", FM modulation is carried out so that it may be set to 21.05kHz, and the WOBURU signal SWB whose center frequency is 22.05kHz is generated.
[0035] When a disk rotates by standard speed, WOBURU is formed in an optical disk 10 so that the WOBURU signal SWB as shown in drawing 6 B may be acquired.
[0036] Drawing 7 shows the configuration of the optical disk unit 20 using the above-mentioned optical disk 10. By the spindle motor section 22, an optical disk 10 rotates at the rate of predetermined. In addition, with the spindle driving signal SSD from the spindle motor mechanical component 23 mentioned later, the spindle motor section 22 is driven so that the rotational speed of an optical disk 10 may turn into a predetermined rate.
[0037] The laser beam by which the quantity of light was controlled is irradiated from the optical pickup 30 of an optical disk unit 20 by the optical disk 10. The laser beam reflected with the optical disk 10 is irradiated by the photodetection section (not shown) of an optical pickup 30. The photodetection section is constituted using the division photodetector etc., by photo electric conversion and current potential conversion, generates the voltage signal according to the reflected light, and supplies it to the RF amplifier section 32.
[0038] In the RF amplifier section 32, the read-out signal SRF, the focal error signal SFE, the tracking error signal STE, and the WOBURU signal SWB are generated based on the voltage signal from an optical pickup 30. The read-out signal SRF, the tracking error signal STE, and the focal error signal SFE which were generated in this RF amplifier section 32 are supplied to clock generation / servo control section 33. Moreover, the WOBURU signal SWB is supplied to the ATIP decoder 34.
[0039] The focal control signal SFC for controlling the objective lens (not shown) of an optical pickup 30 by clock generation / servo control section 33 based on the supplied focal error signal SFE, so that the focal location of a laser beam turns into a location of the record layer of an optical disk 10 is generated, and a driver 35 is supplied. Moreover, the tracking control signal STC for controlling the objective lens of an optical pickup 30 based on the supplied tracking error signal STE, so that the exposure location of a laser beam turns into a mid gear of a desired truck is generated, and a driver 35 is supplied.
[0040] In a driver 35, while generating the focal driving signal SFD based on the focal control signal SFC, the tracking driving signal STD is generated based on the tracking control signal STC. By supplying this generated focal driving signal SFD and the tracking driving signal STD to the actuator (not shown) of an optical pickup 30, the location of an objective lens is controlled, and it is controlled so that a laser beam connects a focus with the mid gear of a desired truck.
[0041] Moreover, in clock generation / servo control section 33, the asymmetry amendment of the read-out signal SRF and binary-izing which were supplied are performed, it changes into a digital signal, and the frame synchronization detecting element 39 and the data-processing section 40 are supplied as a read-out data signal DRF. Moreover, in clock generation / servo control section 33, generation of clock signal CKRF of the read-out data signal DRF is also performed, and generated clock signal CKRF is supplied to the data-processing section 40.

[0042] By the way, there is a read-only optical disk among the optical disks, and there is an optical disk which can be written in. These differences can be distinguished by detecting the existence of PURIGURUBU formed in the optical disk. Only the optical disk of a write-in mold is because PURIGURUBU exists. Since distinction of this optical disk is already known, that explanation is omitted. Therefore, it is necessary to distinguish the difference between the normal density in a read-only optical disk, and high density, and to distinguish the difference between the normal density in the optical disk of a write-in mold, and high density.
[0043] Therefore, in the clock generation / servo control section 33 shown in drawing 7, the optical disk of normal density or the optical disk of high density is distinguished by supplying generated clock signal CKRF also to a control section 50 further, and comparing the clock frequency in a standard disk rotational speed.
[0044] Drawing 8 shows the configuration of a part of clock generation / servo control section 33, and the frame synchronization detecting element 39. The read-out signal SRF supplied from the RF amplifier section 32 is supplied to a waveform equalization circuit 332, after a low-pass component is removed with a high-pass filter 331. In a waveform equalization circuit 332, an intersymbol interference is removed to the signal from a high-pass filter 331. The signal SRFC with which this intersymbol interference was removed is supplied to a limiter circuit 333 and the drop out detector 334.
[0045] In a limiter circuit 333, by slicing the signal SRFC supplied from the waveform equalization circuit 332 using the slice level signal SL from the amplifier 336 mentioned later, as binary-ization is performed and the acquired binary-ized signal was mentioned above, the edge detector 337, the frame synchronization detecting element 39, and the data-processing section 40 are supplied as a read-out data signal DRF. Moreover, the amount of offset by asymmetry is detected by supplying the read-out data signal DRF to an integrator 335. By amplifying this detected amount of offset with amplifier 336, and supplying it to a limiter circuit 333 as a slice level signal SL, the read-out data signal DRF is generated so that the amount of offset of asymmetry may be lost.
[0046] Moreover, changing the signal level of the slice level signal SL at the time of a drop out is prevented by stopping actuation of an integrator 335 with the signal ST when a drop out is detected in the drop out detector 334.
[0047] In the edge detector 337, the changing point of the signal level of the read-out data signal DRF is detected, and the detecting signal KT is supplied to the clock circuit 338. In the clock circuit 338, clock signal CKRF of the read-out data signal DRF is generated using a detecting signal KT, and the frame synchronization detecting element 39, the data-processing section 40, and a control section 50 are supplied.
[0048] In the frame synchronization detecting element 39, while driving a shift register 391 using supplied clock signal CKRF, the read-out data signal DRF is supplied to a shift register 391, and a sequential transfer is carried out. While supplying the pattern detector 392 by making into a parallel signal the read-out data signal DRF by which the sequential transfer was carried out with this shift register 391, a frame alignment signal is detectable in the pattern detector 392 by distinguishing whether the supplied parallel signal is equal to the signal pattern of a frame alignment signal. The alignment pattern detecting signal DTS which shows detection of the frame alignment signal in this synchronous detector 393 is supplied to a control section 50.
[0049] Moreover, in clock generation / servo control section 33, the thread control signal SSC for moving an optical pickup 30 in the direction of a path of an optical disk 10 is generated, and the thread section 36 is supplied so that the exposure location of a laser beam may not exceed a tracking control range. In the thread section 36, a thread motor (not shown) is driven based on this thread control signal SSC, and an optical pickup 30 is moved in the direction of a path of an optical disk 10.
[0050] Clock signal CKRF generated in clock generation / servo control section 33 is further supplied also to a control section 50. When the optical disk of high density is chosen as the optical disk twice the recording density of normal density, an optical disk 1.4 times the clock frequency of normal density serves as a clock frequency of the optical disk of high density.
[0051] In the control section 50, the data-processing system to the optical disk of normal density and the

data-processing system to the optical disk of high density are changed by detecting this delta frequency by counting the number of clocks per unit time amount, and supplying that detection output CTB to the data-processing section 40.
[0052] Drawing 9 shows the gestalt of operation of the data-processing section 40. The data-processing section 40 is constituted from decoder 40A of a regenerative signal DRF, and encoder 40B of record data by this example.
[0053] And with the gestalt of this operation, decoder 40A for playback consists of decoder 401A used when decoding the regenerative signal DRF from the optical disk of normal density, and decoder 402A used when decoding the regenerative signal DRF from the optical disk of high density, and one of decoder 401A or 402A are chosen by the detecting signal from a control section 50.
[0054] Encoder 40B of record data consists of encoder 401B used when recording a data signal WD on the optical disk of normal density, and encoder 402B used when recording a data signal WD on the optical disk of high density, and the either is chosen by the selection signal from a control section 50. Since the thing of normal density correspondence of the optical disk and the thing of high density correspondence is beforehand known when writing a data signal WD in an optical disk, from a control section 50, encoder 401B or 402B to which the selection signal which the operator directed corresponds is supplied.
[0055] The ATIP decoder 34 to which the WOBURU signal SWB is supplied is considered as the configuration shown in drawing 10 . This ATIP decoder 34 also consists of decoding section 34A for normal density, and decoding section 34B for high density.
[0056] The WOBURU signal SWB is supplied to the band-pass filter 341 which constitutes decoding section 34A for normal density. The WOBURU signal SWB band-limited with this band-pass filter 341 so that a WOBURU component might be taken out is supplied to the waveform-shaping section 342.
[0057] In the waveform-shaping section 342, while generating clock signal CKWB which synchronized with the carrier component of the WOBURU signal SWB, binary-ization of the WOBURU signal SWB is performed. This generated clock signal CKWB and the WOBURU signal DWB made binary are supplied to the detection section 343.
[0058] In the detection section 343, recovery processing of the WOBURU signal DWB is performed using clock signal CKWB, and while generating the biphase signal DBP, clock signal CKBP which synchronized with the biphase signal DBP is generated. This biphase signal DBP and clock signal CKBP that were generated are supplied to the address decoding section 344.
[0059] In the address decoding section 344, recovery processing of the biphase signal DBP is performed using clock signal CKBP, and the ATIP information signal DAD is generated. Moreover, the synchronizing signal of the acquired ATIP information signal DAD is detected, and the ATIP synchronous detecting signal FSY is generated.
[0060] Decoding section 34B for high density as well as decoding section 34A for normal density is constituted, and the ATIP information signal DAD and the ATIP synchronous detecting signal FSY are generated through the same processing. Therefore, it stops for decoding section 34B for high density to attach a corresponding sign.
[0061] As for a pair of signals DAD and FSY acquired from each, it is chosen by the change means 345 the any they are. The change control signal according to the optical disk of normal density or high density is supplied to a terminal 346 from a control section 50. While the selected ATIP information signal DAD and the selected ATIP synchronous detecting signal FSY are supplied to a control section 50, the ATIP synchronous detecting signal FSY is supplied to the spindle motor mechanical component 23.
[0062] Thus, when an optical disk is a read-only optical disk, the optical disk of normal density and the optical disk of high density can be distinguished using the clock signal of the regenerative signal when rotating an optical disk by standard speed. Therefore, disk distinction is performed through the following procedures.
(1) After setting up the location of an optical pickup 30 by the delivery device of the thread section 36 roughly, drive the spindle motor section 22 so that FG servo may be applied and it may become a fixed

rotational frequency.
(2) Perform a focal search and control to carry out a focus just to an optical disk 10.
(3) Even if the tracking servo after a focal search applies, it is not necessary to apply it.
(4) Apply a laser beam to an optical disk 10, and acquire a regenerative signal. And clock signal CKWB is obtained.
(5) Measure the number of clocks of clock signal CKWB with the counter in a control section 50, and distinguish the optical disk of normal density, or the optical disk of high density.
(6) Output a distinction result to a required part.
[0063] The disk distinction approach in a read-only optical disk can also take the following approaches. This distinction approach is an approach of using the burst error (the C2 so-called error) of the CIRC sign which is an error correcting code.
[0064] Since the amount of data settled in the same area increases as recording density carries out densification, it is necessary to also heighten error correction capacity according to recording density. For example, in the present optical disks (CD etc.), the amount D of unit delay at the time of interleave processing is set as D= 4 (frame). In the case of the optical disk of high density, it is suppliable with the fall of error correction capacity setting this amount D of unit delay to D= 4 or more values, D= 7 [for example,] etc. About being referred to as D= 7, it is already known (for example, JP,9-91882,A etc.).
[0065] Thus, since the amount D of unit delay at the time of interleave processing is different, one configuration considered as the processing section (decoding section) of an error correcting code including day interleave processing is preparing separately the processing section the object for normal density, and for high density, as shown in drawing 9 . It becomes larger than the burst error when inputting the regenerative signal of the amount D= 4 of unit delay, the error signal, for example, the burst error, when inputting the regenerative signal of the amount D= 7 of unit delay into the decoding section corresponding to the amount D= 4 of unit delay at this time.
[0066] Therefore, it can be judged as what the regenerative signal with which interleave processing of the direction with few burst errors when adding a regenerative signal to each of the decoding section set as the amount D= 4 of unit delay and the decoding section set as the amount D= 7 of unit delay at coincidence was carried out in the amount of right unit delay inputted. By using a burst error from this, an optical disk can be distinguished and the decoding section can be chosen using the distinction output.
[0067] Then, the example is shown. Since there is especially no need of supplying a clock signal as shown in drawing 7 to a control section 50 when using a burst error, it becomes the configuration of an optical disk unit like drawing 11 in this case. It can constitute like drawing 12 as the data-processing section 40 then used.
[0068] If it explains from data-processing section 40A in drawing 12 , after supplying the read-out data signal DRF to the EFM demodulator 71 and carrying out an EFM recovery, the decoding section 72 for normal density which performs error correction processing (CIRC processing) including day interleave processing will be supplied.
[0069] The amount D of unit delay in this decoding section 72 is set as D= 4, serves as right day interleave processing at the time of D= 4, and the error correction processing and day interleave processing by CIRC are performed using RAM41. The regenerative signal after error correction processing is supplied to the change means 74.
[0070] An EFM recovery output is similarly supplied further to the decoding section 73 for high density. The amount D of unit delay used for day interleave processing in this decoding section 73 is D= 7 as mentioned above, for example. D= 7 is an example and can also use other numeric values. In the example of error signal ** obtained from the decoding sections 72 and 73, respectively, a burst error (C2 error signal) is supplied to the size judging section 75 of the error which constitutes the disk distinction section, and the size of a burst error (error block count) is judged.
[0071] A judgment result is supplied to the change means 74. Since decoding of the direction with few burst errors is considered to be error correction processing by the amount of right unit delay, the decoding section of the direction with few burst errors is chosen.
[0072] For example, when reproducing a signal from the optical disk 10 with which interleave

processing was carried out as D= 4, and the amount of unit delay was recorded, When this regenerative signal DRF inputs into each decoding section 72 and 73 The direction of the error block count of the burst error obtained from the decoding section 72 side Since it is fewer than the error block count of the burst error obtained from the decoding section 73 side, the optical disk currently played in this case is judged to be the optical disk of normal density, and chooses the output of the decoding section 72 with the change means 74.

[0073] When reproducing a signal contrary to this from the optical disk 10 with which interleave processing was carried out as D= 7, and the amount of unit delay was recorded, When this regenerative signal DRF inputs into each decoding section 72 and 73 The direction of the error block count of the burst error obtained from the decoding section 73 side Since it is fewer than the error block count of the burst error obtained from the decoding section 72 side, the optical disk currently played in this case is judged to be the optical disk of high density, and chooses the output of the decoding section 73 with the change means 74.

[0074] The selected regenerative signal performs descrambling processing, error correction processing by ECC (Error Correcting Code), etc. in the error correction processing section 76 with a descrambling function further. After the data signal with which error correction processing was made is stored in RAM42 as buffer memory, it is supplied to an external computer apparatus etc. through an interface 43 as playback data signal RD.

[0075] Moreover, the synchronizing signal detecting element 88 is supplied, and the signal after an EFM recovery detects a frame alignment signal FSZ from a recovery signal, and supplies the spindle motor mechanical component 23. In this spindle motor mechanical component 23, the spindle driving signal SSD for rotating an optical disk 10 at the rate of a request is generated using the frame alignment signal FSZ from the data-processing section 40, or the ATIP synchronous detecting signal FSY from the ATIP decoder 34 at the time of playback of the signal currently recorded on the optical disk 10 using the ATIP synchronous detecting signal FSY from the ATIP decoder 34 at the time of the signal record to an optical disk 10. By supplying the spindle driving signal SSD generated by this spindle motor mechanical component 23 to the spindle motor section 22, an optical disk 10 rotates at the rate of a request.

[0076] furthermore, in data-processing section 40B which performs encoding processing When the record data signal WD is supplied through an interface 43 from an external computer apparatus While storing this record data signal WD in RAM42 temporarily, in the encoder 81 for a format While reading the record data signal WD stored in RAM42 and encoding to a predetermined sector format, in the adjunct 82 of an error correcting code with a latter scramble function, ECC for error corrections is added to the record data signal by which scramble processing was carried out.

[0077] Then, the CIRC encoding sections 83 and 84 are supplied. One encoding section 83 is an encoder used when recording data on the optical disk for normal density, CIRC processing and interleave processing are performed and the amount D of unit delay at the time of interleave processing is made with D= 4.

[0078] The encoding section 84 of another side is an encoder used when recording data on the optical disk for high density, CIRC processing and interleave processing are performed and the amount D of unit delay at the time of interleave processing is made with D= 7. As for the output of the encoding sections 83 and 84, one of these is chosen with the change means 85. By the change signal outputted from a control section 50, it changes to the c or d side. The encoding section 83 suitable for the optical disk which it uses in this case since it is specified beforehand whether recording density records data in a control section 50 using which type of optical disk, or 84 is chosen. Eight-to-fourteen modulation processing is further performed by the eight-to-fourteen modulation machine 86, and the selected encoding output generates the final write-in signal DW. This write-in signal DW is supplied to the write-in compensation section 37 (refer to drawing 11).

[0079] In the write-in compensation section 37, the laser driving signal DLA is generated based on the supplied write-in signal DW, and the laser diode of an optical pickup 30 is supplied. Here, in the write-in compensation section 37, based on the power compensatory signal PC from a control section 50 mentioned later, according to the property of the record layer of an optical disk 10, the spot

configuration of a laser beam, record linear velocity, etc., the signal level of the laser driving signal DLA is amended, the power of the laser beam outputted from the laser diode of an optical pickup 30 is optimized, and record actuation of a signal is performed.

[0080] ROM51 is connected to the control section 50, and actuation of an optical disk unit 20 is controlled based on the program for motion control memorized by ROM51. For example, based on the signals DSQ, such as a sub-code generated in the data-processing section 40, or the ATIP information signal DAD from the ATIP decoder 34, a playback location, a record location, etc. on an optical disk 10 are distinguished, a control signal CTB etc. is supplied to clock generation / servo control section 33 at a control signal CTA or the data-processing section 40, and record playback actuation of data is performed. Moreover, the power compensatory signal PC is generated based on the setting information on record laser power shown with the ATIP information signal DAD, and the write-in compensation section 37 is supplied.

[0081] In addition, a control signal CTC is supplied to the RF amplifier section 32 from a control section 50, and in order to reduce the disturbance to the on-off control, laser noise, and read-out signal of a laser diode of an optical pickup 30 by the RF amplifier section 32, processing in which a RF is made to superimpose on a laser beam is performed. Moreover, in a control section 50, disk distinction of whether an optical disk is a high density optical disk with which large capacity-ization of storage capacity was attained is performed based on the ATIP synchronous detecting signal FSY from the ATIP decoder 34, or the alignment pattern detecting signal DTS from the frame synchronization detecting element 39.

[0082] Also in the configuration of drawing 12 , when distinguishing an optical disk, it will pass through the following procedures.

(1) After setting up the location of an optical pickup 30 by the delivery device of the thread section 36 roughly, drive the spindle motor section 22 so that FG servo may be applied and it may become a fixed rotational frequency.

(2) Perform a focal search and control to carry out a focus just to an optical disk 10.

(3) Perform the tracking servo after a focal search.

(4) Apply a laser beam to an optical disk 10, and acquire a regenerative signal.

(5) While carrying out day interleave processing by D= 4, decode a CIRC sign and count the burst error block count.

(6) While carrying out day interleave processing by D= 7, decode a CIRC sign and count the burst error block count.

(7) If the burst error block count has little direction at the time of D= 4, it will be judged as the optical disk of normal density, and if the burst error block count has little direction at the time of D= 7, it will be judged as the optical disk of high density.

[0083] Then, the gestalt of other operations in the data-processing section 40 shown in drawing 12 is explained below. day interleave processing in which the amount D of unit delay was set as D= 4 and D= 7 with the gestalt of operation of drawing 12 , and the CIRC processing sections 72 and 73 -- coincidence -- driving -- respectively -- since -- the burst error obtained -- being based -- distinction of a disk -- carrying out -- the processing section 72 or 73 -- that selection is performed. Thus, distinction processing is not performed to coincidence but the gestalt of operation shown below performs distinction processing at a ceremony one by one.

[0084] If it is in decision processing of this sequential type, when the burst error in D= 4 is detected first and a burst error does not exist (i.e., when the error block count is zero), it is not necessary to carry out decision processing of D= 7, and day interleave processing and the CIRC processing section 72 are chosen.

[0085] When the burst error of D= 4 is not zero, the burst error obtained from the day interleave processing and the CIRC processing section 73 which were set as D= 7 is referred to. When the burst error at that time is zero, it judges that it is a high-density disk, and day interleave processing and the CIRC processing section 73 are chosen.

[0086] Thus, in choosing the data-processing section as a formula one by one, there is no necessity of working day interleave processing and the CIRC processing sections 72 and 73 to coincidence. In that

case, clock signal CKRF supplied to each like drawing 13 can be alternatively worked by supplying alternatively.

[0087] Therefore, as shown in drawing 13 in this case, the changeover switch 77 with which clock signal CKRF is supplied is formed, and clock signal CKRF is alternatively supplied to the processing sections 72 and 73. The processing section to which clock signal CKRF is not supplied serves as the so-called sleep mode (standby mode).

[0088] Therefore, the distinction output generated in the error distinction section 75 is supplied to the control section 50 shown in drawing 11 , the switching signal SWC generated by the control section 50 is supplied to a changeover switch 77 through a terminal 78, and it is made with operating status one by one by performing supply control of a clock signal which was mentioned above. When it follows, for example, the processing section 72 is chosen, clock signal CKRF will hold the change condition of illustration. If this sequential processing is performed, since the unnecessary circuit system serves as a sleep mode, it is a means effective in power saving.

[0089] next, also in drawing 12 , it comes out so, but as the data-processing section 40, the decoder for criteria and the decoder for high density have taken the gestalt which became independent, respectively. However, since it is the day interleave processing section, the part which is fundamentally different is enough if it has the processing section the object for criteria, and for high density only for this day interleave processing section. Drawing 14 is the gestalt of operation of the data-processing section 40 which followed such an idea. The same sign is given to the same part as drawing 12 , and the explanation is omitted.

[0090] If it explains from a recording system, after the data signal WD which was inputted via the interface 43 and which should be recorded is encoded by sector format predetermined with the encoder 81 for a format, scramble processing and attached processing of ECC for error corrections will be performed in a scramble and the ECC processing section 82. Then, the parity of a Reed Solomon code is added with C2 encoder 872.

[0091] C2 encoding output is the interleave processing section 873, and interleave processing which makes D= 4 or D= 7 the amount of unit delay is performed. Therefore, in this interleave processing section 873, it consists of D= 4, the 1st made interleave processing section 873A, and D= 7 and 2nd made interleave processing section 873B. And interleave processing according to the difference in the recording density of the optical disk with which this interleave processing section 873 was supplied and loaded with the change signal from a control section 50 through the terminal 874 is performed.

[0092] Interleaved C2 encoding output is further supplied to C1 encoder 875, a Reed Solomon code is encoded C1, and predetermined parity is added. After only an odd number symbol is delayed by the odd number delay section 876 by one frame, as for C1 encoding output and the interleave output to which parity was added, the sign is reversed only for the symbol of parity by the following sign pars inflexa 878. After performing this processing, 8 -14 transform processing is performed in the EFM processing section 86, and it is recorded on an optical disk 10.

[0093] The reversion system of a data signal is as follows. After the regenerative signal DRF reproduced from the optical disk 10 is changed 14 to eight times in the EFM processing section 71 and being returned to the 8 original sample data, contrary to the time of record, only an even number sample is delayed by the even number delay section 772, and the time series of all samples is arranged. The reversal process of the parity code attached to the CIRC sign by the parity pars inflexa 773 after that is performed, and it is returned at the time of record. And decode processing of a CIRC sign is performed by C1 decoder 774.

[0094] The playback symbol of the CIRC sign and others which were decoded is supplied to the day interleave processing section 775. The day interleave processing section 775 has 1st day interleave processing section 775A set as D= 4, and 2nd day interleave processing section 775B set as D= 7, and which the day interleave processing sections 775A and 775B are chosen by the change signal supplied from a control section 50 through a terminal 779.

[0095] After the decoding output by which day interleave processing was carried out is supplied to C2 decoder 776 and decoding of C2 is performed, descrambling processing is carried out in the

descrambling section 76, and the original record data RD are reproduced.
[0096] With the gestalt of this operation, it is high-density and distinguishes automatically whether the two day interleave processing sections 775A and 775B from which the amount of unit delay differs as the day interleave processing section 775, respectively as mentioned above are formed, and the set optical disk 10 is recorded with standard recording density, or it is recorded. Therefore, the playback error signal from C2 decoder 776 is supplied to a control section 50 in this example through a terminal 777 like drawing 14 , and distinction processing is performed.
[0097] Here, the playback error signal from C2 decoder 776 is C2 error signal, i.e., a burst error, and is outputted as the error block count. With the gestalt of this operation, the playback error signal from C1 decoder 774 is also used as the object for disk distinction, and another object for error distinction if needed. Therefore, this playback error signal is supplied to the control section 50 mentioned above through the terminal 778.
[0098] Distinction processing of a disk is performed in a control section 50. The gestalt of the operation is explained below. The gestalt of this operation is the example of formula distinction processing one by one, distinction processing which used 1st day interleave processing section 775A first is performed, and distinction processing which used 2nd day interleave processing section 775B next is performed.
[0099] 1st day interleave processing section 775A is chosen first. In choosing, the technique of supplying clock signal CKRF alternatively, as mentioned above is employable.
[0100] The amount of unit delay is chosen as D= 4 corresponding to normal density in 1st day interleave processing section 775A. When the burst error BE4 from C2 decoder 776 at that time is detected and a burst error BE4 does not exist (i.e., when the error block count is zero), it is not necessary to carry out decision processing to D= 7, and day interleave processing section 775A is chosen.
[0101] When the burst error BE4 of D= 4 is not zero, 2nd day interleave processing section 775B set as D= 7 is operated, and the burst error BE7 at that time is referred to. When a burst error BE7 is zero, it judges that it is a high-density disk, and day interleave processing section 775B is used as the day interleave processing section at the time of playback as it is.
[0102] Next, processing in case neither a burst error BE4 nor BE7 is zero is explained. In this case, it determines also with reference to C1 error signal (random error RE) obtained from C1 decoder 774. A random error RE can use the error block count when carrying out playback, for example for 1 second (75 sub-code frame = a part for 1 sector). The error block count of this random error RE is compared with the 1st reference value refD for disk distinction. It can be chosen as the 10-20 error block counts as 1st reference value refD.
[0103] When a random error RE is below the 1st reference value refD, it considers that the optical disk is an optical disk for high density, and 2nd day interleave processing section 775B is chosen. This is because the probability for such a random error to occur is high when dust etc. has adhered to the front face of the optical disk which it is going to play.
[0104] In the time higher than the 1st reference value redD for whether your being Haruka, when there are few random errors RE than the 2nd reference value refR (for example, 100 error block counts), they choose the day interleave processing section of little direction among the burst errors within a criteria playback period (the upper example for 1 second). For example, when the direction of a burst error BE4 is judged that there is little error block count, the carried optical disk 10 regards it as a standard-illuminant disk, and 1st day interleave processing section 775A is chosen.
[0105] On the other hand, when a random error RE exceeds the 2nd reference value refR and a burst error BE exceeds the 3rd reference value refB (for example, 1000 error block counts), it is already considered the error by another cause instead of the error by difference of recording density. It is because, as for it, recording density is only different and the error of such a big value is not usually generated.
[0106] In that case, an operator is told about the purport which the error has generated by another cause. The notice can be performed by blinking for example, an alarm-display component, or displaying an error message on a panel.
[0107] Then, the optical disk unit using the distinction approach of of the normal density and the high

density over the optical disk of a write-in mold and the distinction approach is explained.
[0108] The distinction approach of of the normal density and the high density over the optical disk of a write-in mold can consider at least two approaches.
(A) How to use the frequency of a WOBURU signal.
(B) How to use this error judging result when the polynomial of an error judging of a cyclic code is different with the optical disk of normal density, and the optical disk of high density.
[0109] As mentioned above about (A) in the case of the optical disk of normal density, the center frequency (fWB) of a WOBURU signal is 22.05MHz. The center frequency (fWB') is set to 1.4 times as many 30.87MHz as this in the optical disk whose recording density is twice the normal density. An optical disk can be certainly distinguished by using this frequency difference.
[0110] The optical disk unit in this case can follow the basic configuration shown in drawing 11 as it is. Moreover, the data-processing section 40 of a regenerative signal DRF is made with the same configuration as what is shown in drawing 9 , and data-processing section (decoder) 401A which decodes the regenerative signal from the optical disk recorded by the normal density other than encoder 40B which consisted of encoders 401B and 402B of a pair, and data-processing section 402A which decodes the regenerative signal from the high-density and recorded optical disk are prepared.
[0111] Although the detection system of dedication can also be prepared in order to detect the frequency of a WOBURU signal, a part of configuration of the ATIP decoder 34 can also be diverted. The operation gestalt of drawing 15 is the latter example.
[0112] The basic configuration of drawing 15 is almost the same as the configuration of the ATIP decoder 34 explained by drawing 10 . A different place is the disk distinction section's 347 being formed, changing with the distinction output, and a means' 345 changing, and controlled.
[0113] The output of the band-pass filter 341 for normal density optical disks and the output of the band-pass filter 351 for high density optical disks are supplied to the disk distinction section 347. A band-pass filter 341 is a filter for passing the frequency band (referring to drawing 16) of the WOBURU signal acquired when the optical disk of normal density is played, and the band-pass filter 351 of another side is a filter for passing the frequency band (referring to drawing 16) of the WOBURU signal acquired when the optical disk of high density is played.
[0114] Therefore, when the rotation drive of the optical disk 10 is carried out at a rate from which the frequency of a WOBURU signal turns into the center frequency and the optical disk under playback is the recording density of normal density, a WOBURU signal is acquired only from a band-pass filter 341, and nothing is outputted from the band-pass filter 351 of another side. In the case of the optical disk of high density, it is this reverse. Therefore, by distinguishing the existence of a filter output, the optical disk under playback can distinguish the thing of normal density, and the thing of high density certainly.
[0115] When only the filter output from a band-pass filter 341 is obtained, it changes with the distinction output and changes to the a side with a means 345. Right ATIP decoding is realizable now.
[0116] Also in the configuration of drawing 15 , when distinguishing an optical disk, it will pass through the following procedures.
(1) After setting up the location of an optical pickup 30 by the delivery device of the thread section 36 roughly, drive the spindle motor section 22 so that FG servo may be applied and it may become a fixed rotational frequency.
(2) Perform a focal search and control to carry out a focus just to an optical disk 10.
(3) After a focal search is in the condition to which performs a tracking servo or a tracking servo is not applied, and carries out the rotation drive of the optical disk 10.
(4) Apply a laser beam to an optical disk 10, and acquire a regenerative signal (WOBURU signal).
(5) Detect each WOBURU frequency from band-pass filters 341 and 351.
(6) When the WOBURU frequency detected at the time of a standard disk engine speed is almost equal to the value (it is 22.05MHz at center frequency) expected as a thing of normal density, distinguish this optical disk from the optical disk of normal density.
[0117] On the other hand, when a WOBURU frequency is a value near the value (that center frequency is 30.87MHz) expected as a thing of high density, this optical disk is distinguished from the optical disk

of high density.
[0118] Since a filter output is obtained only from a band-pass filter 341 when it loads with the optical disk of normal density other than such a distinction approach, an optical disk can also be distinguished by the existence of each filter output. For example, when inputting only the filter output of a band-pass filter 341 into the disk distinction section 347, even if the optical disk judges the optical disk of normal density, it does not interfere.
[0119] Of course, instead of forming the disk distinction section 347, these two filter outputs may be supplied to a control section 50, and existence of the judgment of a WOBURU frequency or a filter output may be judged in software.
[0120] When the polynomial of an error judging of a cyclic code (CRC) is usually the optical disk of normal density about (B), it is P(x)'=x16+x12+x5+1. .... (1)
** -- the judgment of an error is performed using a polynomial [like]. On the other hand, it is possible to set up the polynomial of an error judging of the cyclic code (CRC) in the optical disk of high density so that it may differ from ****. For example, the following polynomials can be considered.
P(x) =x14+x12+x10+x7+x5+x4+x2 +1 ... (2)
[0121] Thus, when performing the error judging of a cyclic code using a different polynomial, a difference of the recording density of an optical disk can be distinguished from the result of a judgment polynomial.
[0122] The optical disk unit in this case can follow the basic configuration shown in drawing 11 as it is. Moreover, the data-processing section 40 of a regenerative signal DRF is made with the same configuration as what is shown in drawing 9 , and data-processing section (decoder) 401A which decodes the regenerative signal from the optical disk recorded by the normal density other than encoder 40B which consisted of encoders 401B and 402B of a pair, and data-processing section 402A which decodes the regenerative signal from the high-density and recorded optical disk are prepared.
[0123] Drawing 17 shows 1 operation gestalt of the ATIP decoder 34 which applied this invention. ATIP decoder 34 the very thing is almost the same as the ATIP decoder configuration of drawing 9 or drawing 15 .
[0124] With this operation gestalt, the disk distinction section 349 is formed and error judging result P (x) to the ATIP information signal DAD decoded in the address decoding section 344 and error judging result P(x)' to the ATIP information signal DAD decoded in the address decoding section 354 are supplied, respectively.
[0125] The size relation of error judging result P (x) and P(x)' is compared by the disk distinction section 349. That is, when it is the optical disk of normal density, it is P(x) =0<P(x)'. .... (3)
When it becomes ****** and is the optical disk of high density, it is P(x) >P(x)'=0. .... (4)
It becomes ******. Based on this distinction result, the change means 345 is controlled so that decoding section 34A or 34B of the smaller one of an error judging result is chosen.
[0126] Also in the configuration of drawing 17 , when distinguishing an optical disk, it will pass through the following procedures.
(1) After setting up the location of an optical pickup 30 by the delivery device of the thread section 36 roughly, drive the spindle motor section 22 so that FG servo may be applied and it may become a fixed rotational frequency.
(2) Perform a focal search and control to carry out a focus just to an optical disk 10.
(3) Perform the tracking servo after a focal search.
(4) Apply a laser beam to an optical disk 10, and acquire a regenerative signal (WOBURU signal).
(5) Error correction result P (x) distinguishes from the optical disk of normal density, when smaller than the value of P(x)', and P(x)' distinguishes from the optical disk of high density, when smaller than the value of P (x).
[0127] Of course, instead of forming the disk distinction section 349, these two filter outputs may be supplied to a control section 50, and error judging result P (x) and P(x)' may be distinguished in software.
[0128] In addition, the error correction result of use [it / not only for the optical disk of a write-in mold

but for distinction of the normal density in a read-only optical disk and high density] of this cyclic code is clear.
[0129] As for the optical disk which should be distinguished with the operation gestalt mentioned above, it is needless to say by not being restricted to CLV, and performing same measurement with a predetermined rotational speed at a position, even if it is the disk of CAV, and the optical disk of zone CLV that distinction of an optical disk can be and can be performed.
[0130]
[Effect of the Invention] As explained above, when the optical disk with which it was loaded in this invention is read-only, it can distinguish simply [be / it / the thing of whether an optical disk is the thing of normal density, and high density], and certainly by detecting the clock frequency of a regenerative signal or detecting a burst error signal. The configuration is also easy. Moreover, depending on the case, it can also be distinguished that the error of the optical disk is an error by not a difference but another cause of recording density.
[0131] Moreover, when the optical disks with which it was loaded are a postscript mold and a rewritable write-in mold, it can distinguish simply [be / it / the thing of whether an optical disk is the thing of normal density, and high density], and certainly by detecting the frequency of a WOBURU signal or detecting the error correction result of a cyclic code. The configuration is also easy.

[Translation done.]

DESCRIPTION OF DRAWINGS

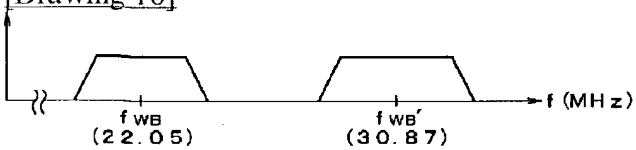
[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the frame structure of the signal recorded on an optical disk.
[Drawing 2] It is drawing showing a frame alignment signal.
[Drawing 3] It is drawing showing the configuration of an optical disk.
[Drawing 4] It is drawing showing the frame structure of ATIP information.
[Drawing 5] It is drawing showing ATIP information and a biphase signal.
[Drawing 6] It is drawing showing the relation between a biphase signal and a WOBURU signal.
[Drawing 7] It is drawing showing the configuration of the optical disk unit when using a read-only optical disk.
[Drawing 8] It is drawing showing a part of configuration of the clock generation / servo control section in drawing 7 , and a frame synchronization detecting element.
[Drawing 9] It is drawing showing the outline configuration of the data-processing section in drawing 7 .

[Drawing 10] It is drawing showing the configuration of the ATIP decoder in drawing 7 .
[Drawing 11] It is drawing showing the configuration of the optical disk unit when using the optical disk of a write-in mold.
[Drawing 12] It is drawing showing the configuration of the data-processing section in drawing 11 (the 1).
[Drawing 13] It is drawing showing the configuration of the data-processing section in drawing 11 (the 2).
[Drawing 14] It is drawing showing the configuration of the data-processing section in drawing 11 (the 3).
[Drawing 15] It is drawing showing the configuration of the ATIP decoder in drawing 11 (the 1).
[Drawing 16] It is the frequency-characteristics Fig. of a band-pass filter.
[Drawing 17] It is drawing showing the configuration of the ATIP decoder in drawing 11 (the 2).
[Description of Notations]
10 ... An optical disk, 20 ... An optical disk unit, 22 ... Spindle motor section, 23 ... A spindle motor mechanical component, 30 ... An optical pickup, 32 ... RF amplifier section, 33 ... Clock generation / servo control section, 34 ... ATIP decoder, 34A ... The decoding section for normal density, 34B ... The decoding section for high density, 345 ... A change means, 35 ... A driver, 36 ... Thread section, 37 ... The write-in compensation section, 39 ... A frame synchronization detecting element, 40 ... Data-processing section, 40A ... A decoder, 40B ... 41 A decoder, 42 ... RAM, 43 ... An interface, 50 ... A control section, 72, 73, 83, 84 ... CIRC processing section, 331 ... A high-pass filter, 332 ... A waveform equalization circuit, 333 ... Limiter circuit, 334 ... A drop out detector, 335 ... An integrator, 336 ... Amplifier, 337 ... An edge detector, 338 ... A clock circuit, 341 ... Band-pass filter, 342 [... The disk distinction section, 391 / ... A shift register, 392 / ... A pattern detector, 393 / ... Synchronous detector] ... The waveform-shaping section, 343 ... The detection section, 344 ... The address decoding section, 347,349

[Translation done.]

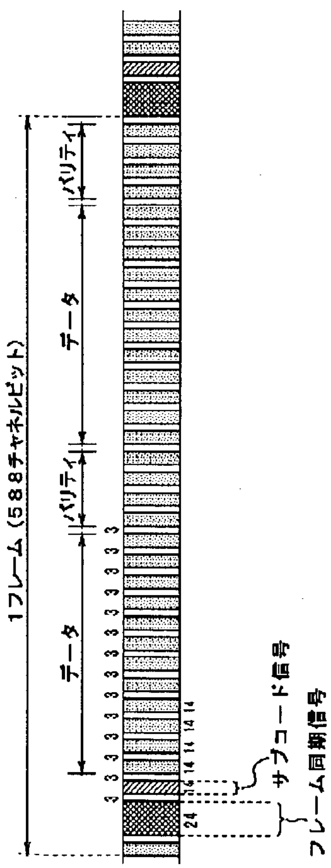
DRAWINGS

[Drawing 16]



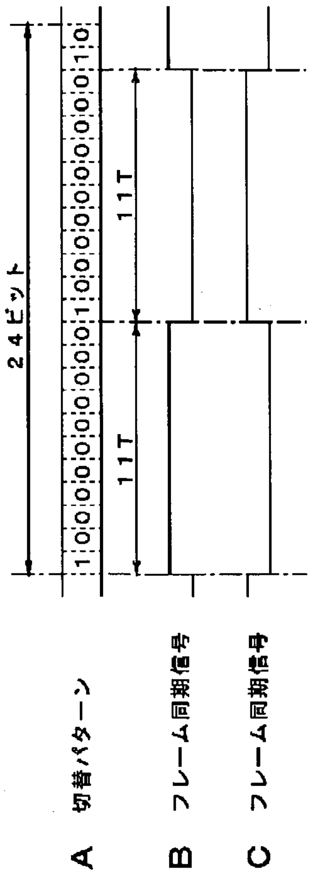
[Drawing 1]

光ディスクに記録される信号の
フレーム構造



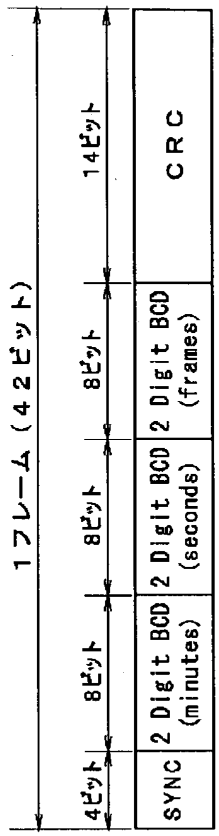
[Drawing 2]

フレーム同期信号



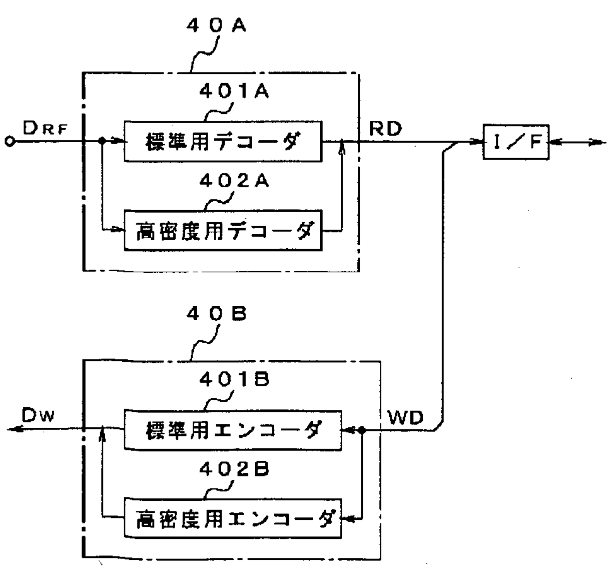
[Drawing 4]

ＡＴＩＰ情報のフレーム構造



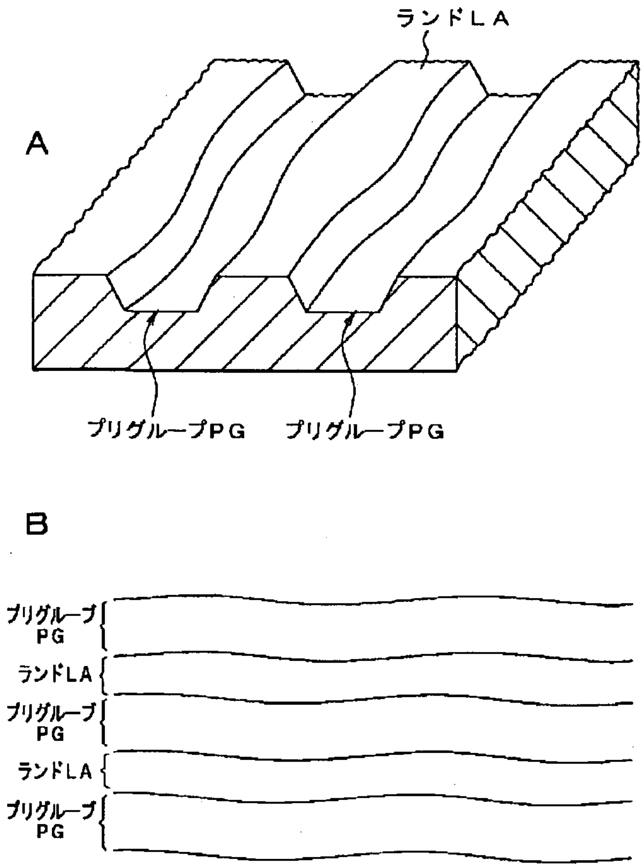
[Drawing 9]

データ処理部４０



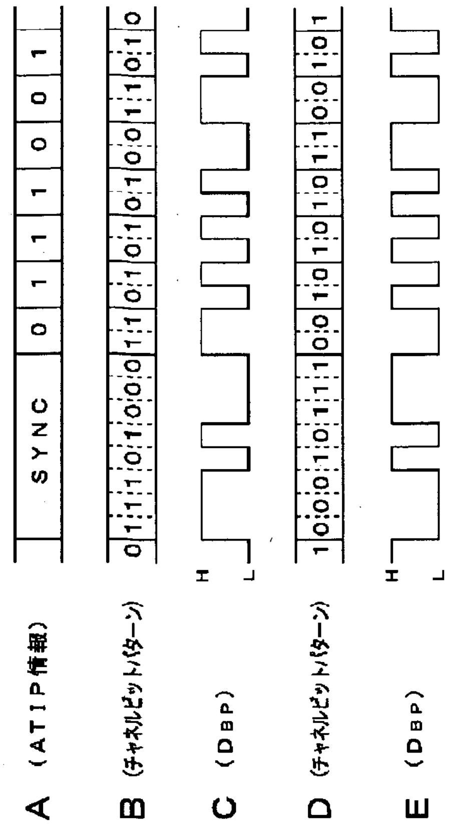
[Drawing 3]

光ディスクの構成

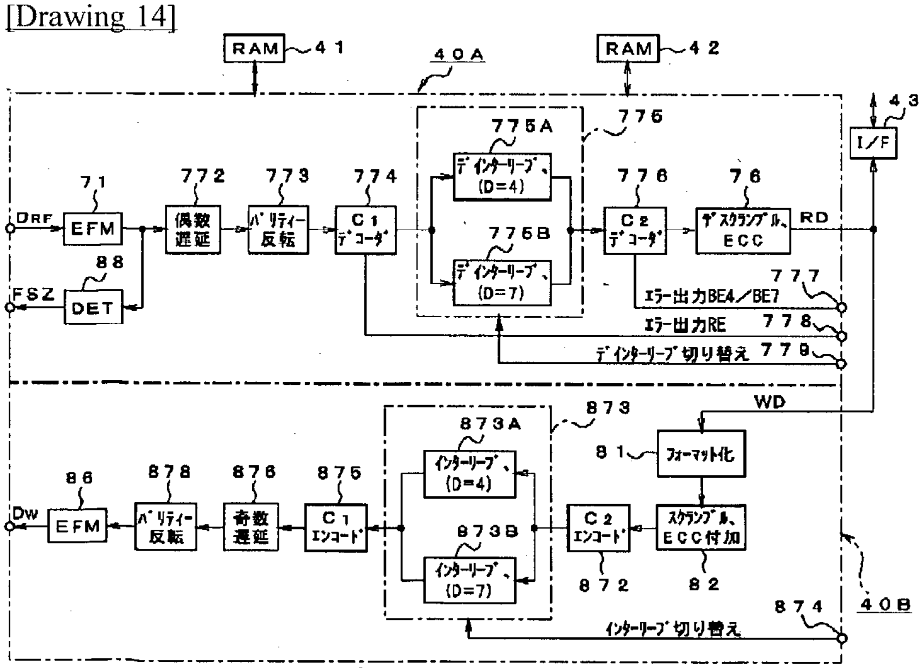


[Drawing 5]

ＡＴＩＰ情報とバイフェーズ
信号ＤＢＰ

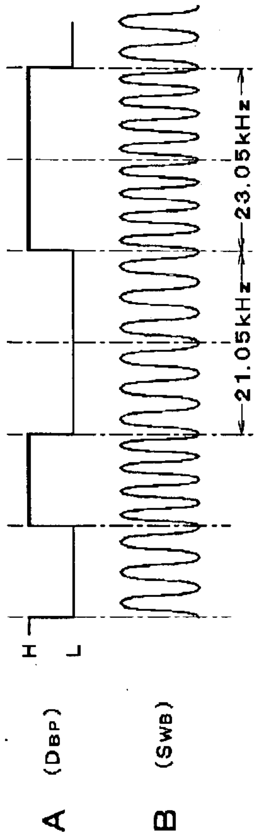


[Drawing 14]

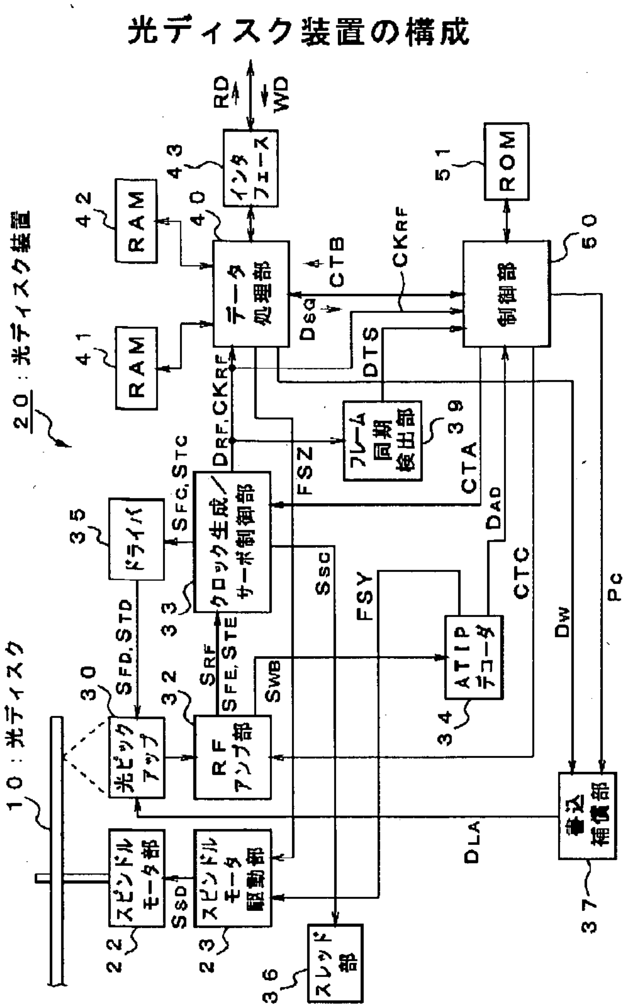


[Drawing 6]

バイフェーズ信号Dと
ウォーブル信号Sの関係

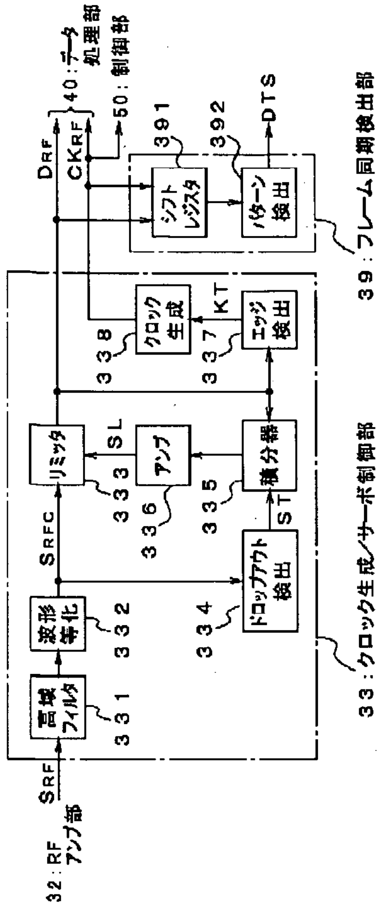


[Drawing 7]


光ディスク装置の構成
20：光ディスク装置
10：光ディスク
RAM
RAM
データ処理部
インタフェース
ROM
制御部
フレーム同期検出部
クロック生成／サーボ制御部
ドライバ
光ピックアップ
RFアンプ部
ATIPデコーダ
スピンドルモータ部
スピンドルモータ駆動部
スレッド部
書込補償部
RD
WD
CTB
CKRF
DTS
DSQ
DRF, CKRF
SFC, STC
SFD, STD
SRF
SFE, STE
SWB
FSZ
SSC
FSY
CTA
DAD
CTC
DW
PC
DLA
SSD
41
42
43
40
51
50
39
35
33
30
32
34
22
23
36
37

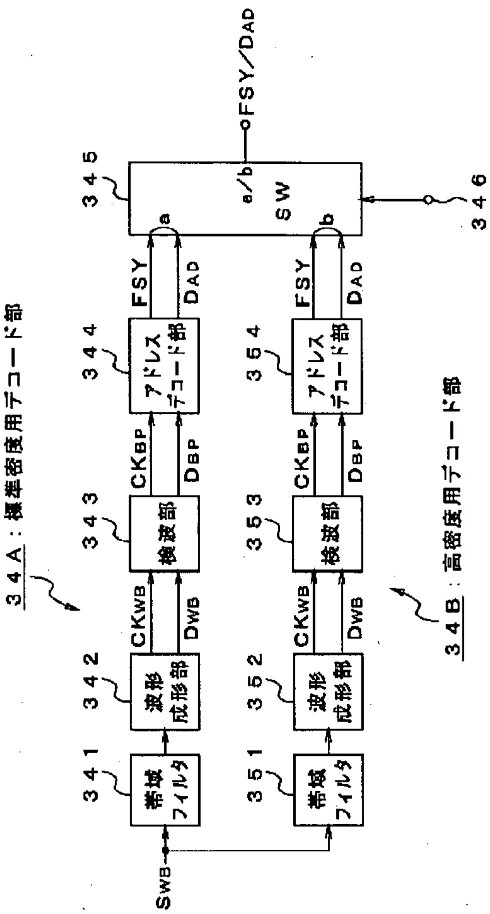
[Drawing 8]

クロック生成／サーボ制御部と
フレーム同期検出部の構成の一部

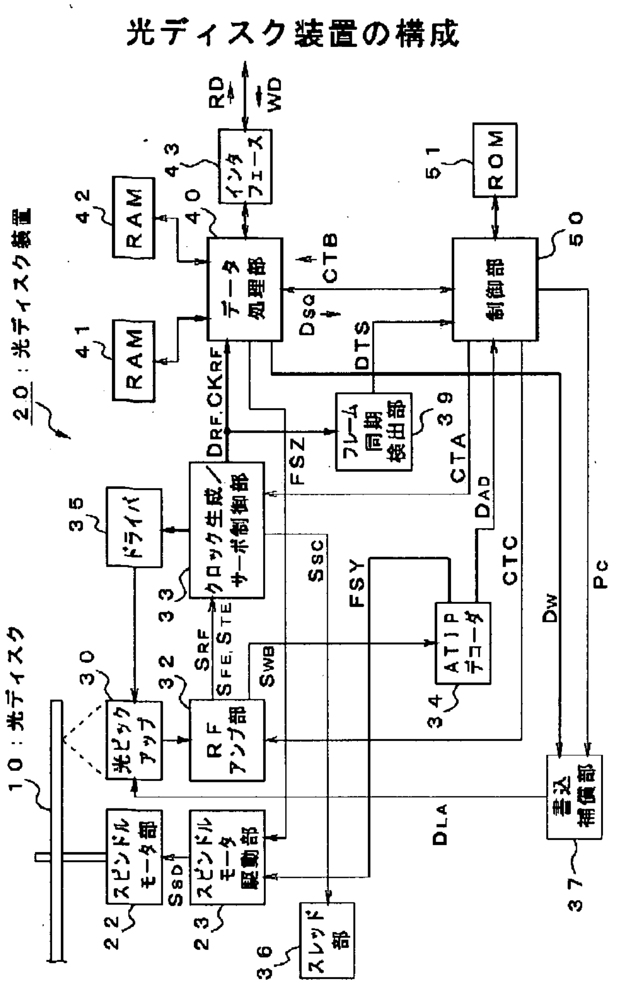


[Drawing 10]

ＡＴＩＰデコーダの構成

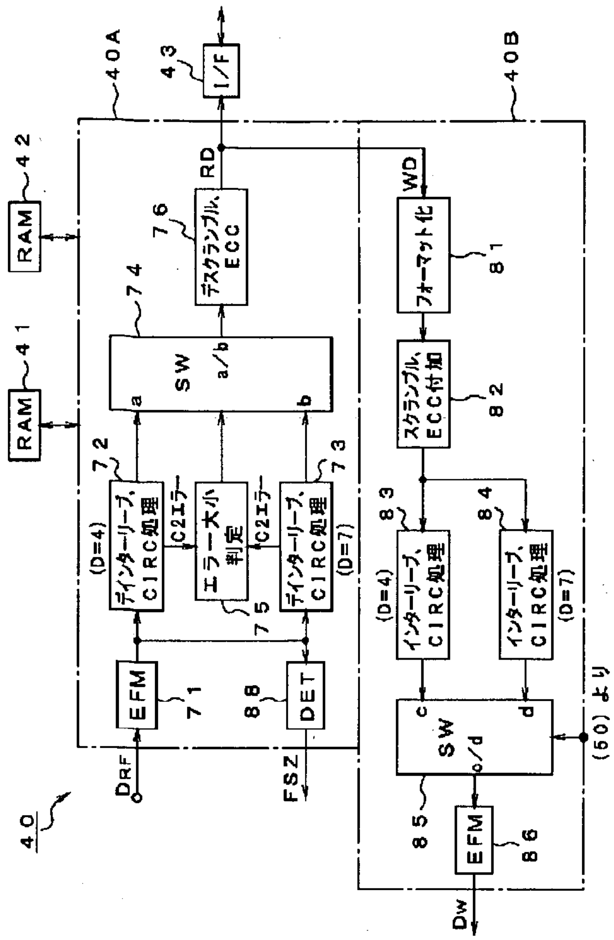


[Drawing 11]


光ディスク装置の構成
20：光ディスク装置
10：光ディスク
RAM
RAM
ROM
インタフェース
データ処理部
制御部
フレーム同期検出部
クロック生成／サーボ制御部
ドライバ
光ピックアップ
RFアンプ部
ATIPデコーダ
書込補償部
スピンドルモータ部
スピンドルモータ駆動部
スレッド部
RD
WD
CTB
DSQ
DTS
DRF.CKRF
FSZ
CTA
DAD
CTC
FSY
SSC
SRF
SFE, STE
SWB
DW
PC
DLA
SSD
41
42
43
40
51
50
39
35
33
32
30
34
37
22
23
36

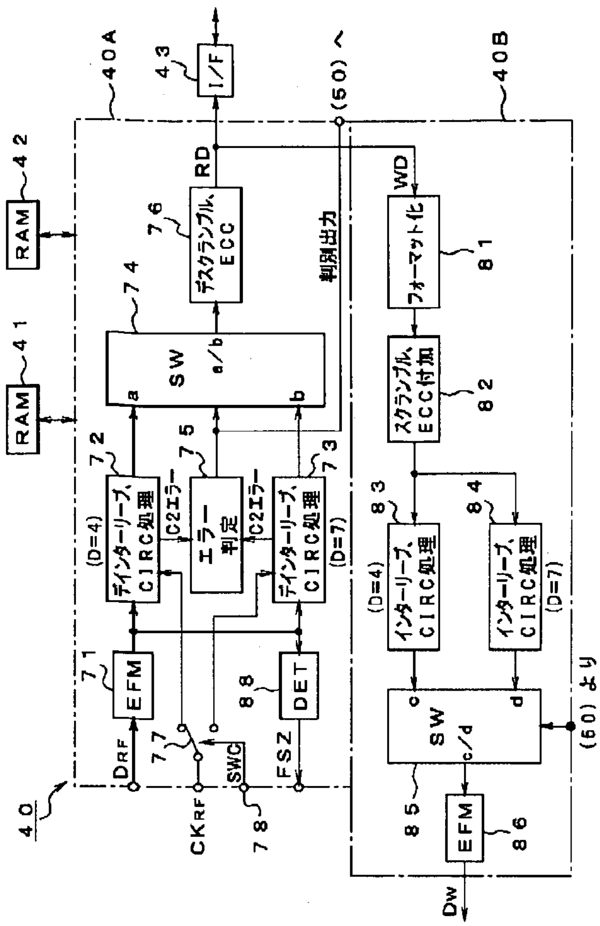
[Drawing 12]

読み出し専用ディスクの場合



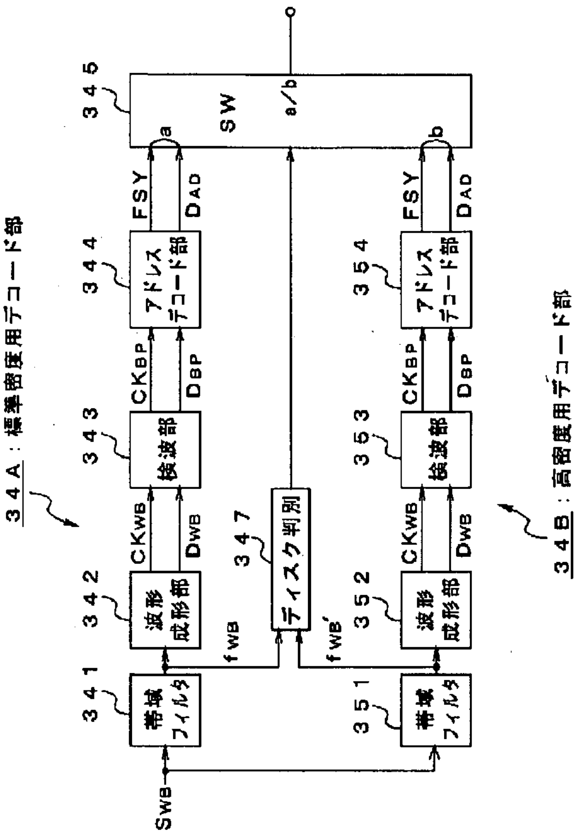
[Drawing 13]

読み出し専用ディスクの場合



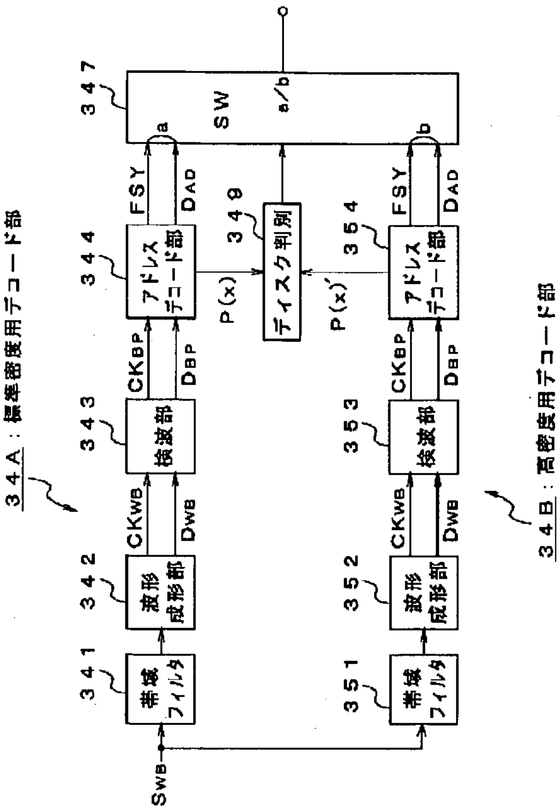
[Drawing 15]

書き込み型ディスクの例



[Drawing 17]

書き込み型ディスクの例



[Translation done.]